

THE RADULA OF THE GENUS *COMINELLA*, H. & A. ADAMS.

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THE genus *Cominella* appears to occur in two principal nuclei of geographical distribution, (1) the Cape, (2) South Australia, Tasmania, and New Zealand. It has not been reported from South American waters, where, in the extreme south, it appears to be replaced by a considerable development of the genus *Euthria*, and, though there is an outlying species (*fucata*, A. Ad.) said, on inconsiderable authority, to come from Japan,¹ it has not been recorded from Western North America. The Philippines is another doubtful locality for another doubtful species (*crocea*, A. Ad.).

Kobelt, in 1878, enumerated² 34 species in all: Cape 12, New Zealand 9, Chatham Is. 1, Port Western 1, South Australia 4, Tasmania 1, Swan R. 1, Darnley Is. 1, doubtful localities 4. Tryon's sweeping methods³ reduced these to about 20. G. B. Sowerby listed⁴ 17 species in all from South Africa, the generic position of 4 of which was doubtful. Paul Bartsch, in 1915, added⁵ 4 more species to this list, making 21 in all. H. Suter⁶ recognizes 10 species from New Zealand and the outlying island groups, from the Kermadecs to Campbell Is., two at least of which (*costata*, Quoy, *lineolata*, Lam.) are also found in Australian waters.⁷

For the purposes of the present paper the radulæ of the following species (all from the collection of the late Professor H. M. Gwatkin) have been examined:—

AUSTRO-NEOZEALANIAN SPECIES.

adelaidensis, Crosse.
alveolata, Kien.
costata, Quoy.
filicea, Cr. & Fisch.
huttoni, Kob.
lineolata, Lam.
lurida, Phil.
maculata, Mart.
maculosa, Mart.
virgata, H. & A. Ad.

CAPE SPECIES.

delalandii, Kien.
elongata, Dunk.
lagenaria, Lam.
limbosa, Lam.
porcata, Gmel.
tigrina, Kien.

I. The general facies of the radula of the AUSTRO-NEOZEALANIAN group is as follows: Rhachidian tooth with three sharp narrow cusps

¹ *Cominella fortilirata*, Sowb., from Urup, Kurile Is., Ann. Mag. Nat. Hist., ser. VIII, vol. xi, 1913, p. 557, seems a very doubtful *Cominella*.

² Jahrb. Deutsch. Malak. Gesell., Bd. v, p. 231.

³ Man. Conch., vol. iii, 1881, pp. 201-7.

⁴ Marine Shells of South Africa, 1892, pp. 9-11.

⁵ Report on the Turton Collection of South African Marine Mollusks (Smithsonian Inst. Bulletin 91).

⁶ Manual of the New Zealand Mollusca, 1913, pp. 381-91.

⁷ W. L. May, Vict. Nat., vol. xxx, 1913, pp. 55-60.

nearly equal in length, set closely together on a base shaped like a truncate horse-shoe, cusps simple; laterals bicuspid on a simple base, cusps large, slightly curved, never denticulate.

I have counted in

<i>adelaidensis</i> ¹	91 +	rows of teeth.	<i>lineolata</i>	123	rows of teeth.
<i>alveolata</i>	113	"	<i>lurida</i>	104	"
<i>costata</i>	107	"	<i>maculata</i>	109	"
<i>filicea</i>	112	"	<i>maculosa</i>	115	"
<i>huttoni</i>	98 +	"	<i>virgata</i>	97 +	"

SPECIAL CHARACTERISTICS OF THE RHACHIDIAN TOOTH IN THE VARIOUS SPECIES.

1. *adelaidensis*.—Cusps rather narrow and close together. The lines of the base are somewhat square, and the two lower prolongations (hereafter called the wings) of the base are thickly rounded.

2. *alveolata*.—Cusps rather short, further apart than in *adelaidensis*, base-lines not quite so square, wings short, rounded at the ends.

3. *costata*.²—Cusps small, narrow, very close together, wings of the base greatly prolonged, narrowed at their lower ends, lines of the base rounded, not squared.

4. *filicea*.—Cusps short, somewhat elevated above the upper base-line, wings of the base prolonged a little, but not nearly so much as in *costata*, angles of base-lines rounded.

5. *huttoni*.²—There is scarcely any recognizable difference between this species and *lineolata*.

6. *lineolata*.—Closely corresponds to *alveolata* both in the form of cusps and shape of base.

7. *lurida*.³—Cusps short, equal in length, rather close together, wings of base decidedly prolonged, but not so much as in *costata*.

8. *maculata*.²—Cusps prominent, close together, base rounded above, wings short and rounded.

9. *maculosa*.—Cusps markedly triangular in shape, well apart from one another, base as in *maculata*.

10. *virgata*.—Cusps sharp and small, separate from one another, base not prolonged into wings, rather angulate above.

The species of the whole group lie remarkably close together, and the one markedly characteristic difference is the prolongation of the wings in *costata*, *filicea*, and *lurida*. The shape of the laterals is constant, and exhibits scarcely any appreciable difference in the various species.

¹ " + " means that a few rows at one or other end of the specimen were missing.

² T. Iredale has pointed out (Trans. N.Z. Inst., xlvii, 1914, p. 465) that by the laws of nomenclature the name *eburnea*, Reeve, must displace *costata*, Quoy, *quoyana*, A. Ad., that of *huttoni*, Kob, and *adpersa*, Brug., that of *maculata*, Mart. These names are accordingly adopted in the explanation of the figures.

³ The dentition of *lurida* has been figured by Hutton, Trans. N.Z. Inst., xiv, 1882, p. 162, pl. vi; that of *maculata*, *maculosa*, and *virgata*, *ibid.*, xv, 1883, p. 120, pl. xiii.

II. The CAPE GROUP of species is distinguished by two very marked types of radula.

(a) Rhachidian tooth rather bluntly tricuspid, base deep and squarish, arched below, no wings; laterals tricuspid, the smaller inner cusp in the Austro-Neozealanian group being replaced by a two-dentieled cusp, simple, deeply cut.

(b) Rhachidian tooth bluntly long oblong, base slightly arched below, angled in front, set with a number (4-7) of small sharp denticles, laterals quadricuspid, large, cusps boldly curved, the three inner forming a group, of which the central is much the largest.

I have counted in

<i>delalandii</i>	112 + rows of teeth,	<i>limbosa</i>	116 rows of teeth.
<i>elongata</i>	109 ,,	<i>porcata</i>	116 ,,
<i>lagenaria</i>	120 ,,	<i>tigrina</i>	95 + ,,

SPECIAL FEATURES OF THE VARIOUS SPECIES.

Group (a).

elongata.—Cusps of the rhachidian tooth not much elevated above the upper edge of the base; base deep, pinched in at the sides and slightly arched below; lateral tricuspid, the two inner cusps very close together, deeply cut.

tigrina.—Cusps of the rhachidian tooth considerably elevated above the upper edge of the base, the two outer cusps set at an angle with the central; base markedly angulated at its upper edge, pinched at the sides, deeply arched below; lateral tricuspid, the two inner cusps further away from another than in *elongata*, not so deeply cut.

Group (b).

delalandii.—Rhachidian tooth with four denticles; base angulated at the upper edge, slightly arched below; lateral showing no sign of denticulation on any of the cusps, exterior of the three interior cusps large, central very large, curved over the interior cusp, which is very small, not serrated.

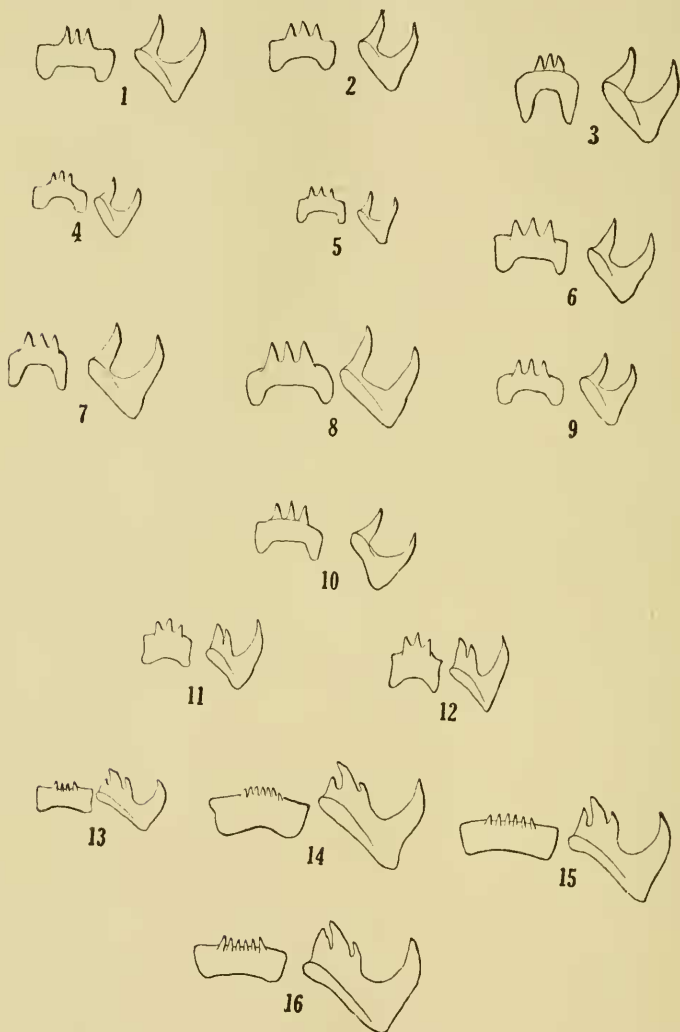
lagenaria.—Rhachidian tooth with seven denticles; upper edge of base slightly produced at the ends, base considerably arched; in the laterals the interior cusp shows signs of serrations on the outer edge, the exterior cusp of the group of three is very small, curiously curved inward.

limbosa.—Rhachidian tooth with six denticles; base squarely oblong, slightly rounded at upper angles, lower edge scarcely arched; both the exterior and interior cusps of the group of three large, blunt, the interior slightly serrated on the inner edge.

porcata.—Denticles of the rhachidian tooth six in number, rather larger than in the other species; base with the upper angles rounded, very slightly arched below; interior cusp of the group of three very large, with faint traces of serration on the inner side, exterior cusp of this group small and narrow. In some of the laterals there are clear traces of a supplementary denticle or knob, between the tricuspid inner tooth and the great outer cusp.

GENERAL CONCLUSIONS.

The species of *Cominella* whose radula has been examined fall into three very well-marked groups, of which (1) is confined to Australia and New Zealand while (2) and (3) are characteristic of the



Cape. The radula of the species comprised in Group 1 are singularly alike in the shape of their teeth, both rhachidian and lateral, while those of the species falling under (2) and (3) manifest considerable individual differences.

Group 1 exhibits teeth of a very simple character. Group 2 is closely allied to Group 1, the most marked point of contrast being the bifid cusp in the lateral. Group 3 is by far the most specialized as regards radula, and, while preserving a certain tie of kinship, stands well apart from the other two, both as regards shape and denticulation of the rhachidian and in the elaboration of the cusps of the laterals.

It is hoped that the facts now brought together may be of use, as throwing light on the general inter-affinities of the group as a whole, and possibly on the vexed question of distinction of species.

EXPLANATION OF FIGURES.

FIG.

1. *Cominella adelaidensis*, Crosse : Australia.
2. " *alveolata*, Kien. (= *lineolata*, Lam.): Port Phillip.
3. " *eburnea*, Reeve (= *costata*, Quoy): New Zealand.
4. " *filicea*, Cr. & Fisch.: Port Jackson.
5. " *quoyana*, A. Ad. (= *huttoni*, Kob.): New Zealand.
6. " *lineolata*, Lam.: Tasmania.
7. " *lurida*, Phil.: New Zealand.
8. " *adspersa*, Brug. (= *maculata*, Mart.): New Zealand.
9. " *maculosa*, Mart.: New Zealand.
10. " *virgata*, H. & A. Ad.: New Zealand.
11. " *elongata*, Dunk.: Cape of Good Hope.
12. " *tigrina*, Kien.: South Africa.
13. " *delalandii*, Kien.: St. James', Cape Town.
14. " *lagenaria*, Lam.: Cape of Good Hope.
15. " *limbosa*, Lam.: Sea Point, Cape Town.
16. " *porcata*, Gmel.: Algoa Bay.

A COLONY OF *NUCELLA* (OLIM *PURPURA*) *LAPILLUS* (LINN.) WITH OPERCULUM MALFORMED OR ABSENT.

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VISITING Lydstep (a few miles west of Tenby) in August, 1915, at a very low tide, I took a living specimen of *N. lapillus* off the face of the cliff, and observed that it had no operculum. Thinking that perhaps the act of pulling the specimen off the rock had torn the operculum away, I examined further specimens, with the result that it appeared that this particular colony of *Nucella* were suffering, to a considerable extent, from malformation of the organ.

Of 121 specimens examined,

- (1) The operculum was more or less perfect in 54.
- (2) " " decidedly imperfect in 56.
- (3) " " absent altogether in 11.

In class 2 the imperfection was not always of the same nature. Sometimes the operculum was considerably reduced in size, so that, when the animal was withdrawn, only a portion of the aperture was covered. Occasionally the operculum was perfect as regards size, but was thin, and of a very light horn colour, almost white, instead